Mother-to-infant bonding: determinants and impact on child development

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1

General introduction

Worldwide about ten percent of pregnant women and 13% of women who have just given birth experience a mental disorder. In developing countries this is even higher. The affected mothers cannot function properly in their parental role (Parsons et al., 2012). As a result, the children's growth and development may be negatively affected. Yet, there are effective interventions available for many maternal mental disorders (WHO, 2008). According to the World Health Organization, maternal and child mental health should be improved, both at the individual and the societal level (WHO, 2019). This can be done by the promotion of mental well-being, the prevention of mental disorders and the care for people affected by mental disorders (WHO, 2019). This dissertation addresses aspects of mental and psychological well-being of mother and child during the sensitive period from pregnancy to early childhood.

Mother-to-infant bonding

Definition

Mother-to-infant bonding is one of the components of mental and psychological well-being. Mother-to-infant bonding is the emotional tie experienced by a mother towards her child. It develops already during pregnancy and remains stable until toddlerhood (de Cock et al., 2016; Kinsey and Hupcey, 2013). Mother-to-infant bonding is unidirectional and represents the feelings towards the child from the mother's perspective only. Rubin suggests that these emotions are vital in the evolving relationship between mother and child, as emotions constitute the principle means of communication (Rubin, 1984). Although mother-to-infant bonding is a continuous process that develops during pregnancy and remains stable until toddlerhood, in the measurement of mother-to-infant bonding a distinction is often made between prenatal and postnatal mother-to-infant bonding. Prenatal and postnatal mother-to-infant bonding can be easily measured with valid and reliable self-report questionnaires (Brockington et al., 2001; Brockington et al., 2006; van Bussel et al., 2010; Condon and Corkindale,1998; Cranley,1981; Cuijlits et al., 2016; Müller, 1993; Taylor et al., 2005).

Mother-to-infant bonding should not be confused with attachment or maternal sensitivity, which are different concepts. Previous research has mostly focused on attachment (Fearon et al., 2010). The attachment-relationship develops at a much later stage (12-18 months postpartum) than bonding and is typically bidirectional (Ainsworth and Bowlby, 1965; Bowlby 1958; Fearon et al., 2010). There are four types. Each type reflects a different kind of attachment relationship with the caregiver, and implies different forms of communication, emotion regulation, and ways of responding to perceived threats. The four types are secure attachment, anxious-avoidant insecure attachment, anxious-resistant insecure attachment, and disorganized and disoriented attachment (Bowlby, 1958; Ainsworth and

Bowlby, 1965). This classification is based on systematic observations in a clinical settings. These observations are not easy to apply for care professionals because practitioners in obstetric, pediatric or primarycare mostly lack the time, facilities and training to classify the attachment-relationship of mother and child.

Mother-to-infant bonding should neither be confused with the concept of maternal sensitivity. Maternal sensitivity focuses on maternal behaviors postpartum. Mothers who exhibited sensitive caregiving behavior were able to attune to infant's signals with attentiveness, appropriately interpret the signals, respond appropriately to the signals, and react promptly, in a time period that did not provoke excessive frustration for the child (Ainsworth et al., 1978).

Relevance

Optimal mother-to-infant bonding is essential for a healthy child development (Mason et al., 2011; Siddiqui and Hägglöf, 2000; de Cock et al., 2017). The prevalence of suboptimal mother-to-infant bonding one year postpartum varies between 5% and 11% in the general population indicating that it may have a substantial impact on public health (O'Higgins et al., 2013; Zanardo et al., 2016).

There are several reasons why mother-to-infant bonding is important. First, optimal mother-to-infant bonding is essential for a healthy socio-emotional child development (Mason et al., 2011). Mason examined whether maternal depressive symptoms were associated with poorer infant socio-emotional development and more negative parent-child interaction, and whether mother-to-infant bonding was involved in this relationship (Mason et al., 2011). He revealed that mother-to-infant bonding was a mediator of the association between a positive screening for maternal depression at 2 months postpartum, and the risk of an impaired socio-emotional development of the child and a dysfunctional parent-child interaction at 6 months (Mason et al., 2011). In Erickson's theoretical framework for psychological health of adolescent mothers and their children, mother-to-infant bonding is also a central component in relation to socio-emotional child development (Erickson, 1996). Secondly, a suboptimal mother-to-infant bonding has been associated with less sensitive and poorer maternal parenting styles and skills such as less postnatal maternal involvement (Siddiqui and Hägglöf, 2000), and an increased risk for the mother to harm the (unborn) child (Pollock and Percy, 1999). Less sensitive, and poorer maternal parenting, in turn, has been linked to insecure attachment as well as depressive, anxious and other negative emotions of the child (McElwain and Booth-LaForce, 2006). Besides this, it is reported that mothers with suboptimal mother-to-infant bonding are more vulnerable to parenting stress, and their children are at risk for developing future executive functioning problems (de Cock et

al., 2017). Furthermore, suboptimal mother-to-infant bonding seems to be associated with negative health behaviors during pregnancy such as cigarette smoking and drinking alcohol (Lindgren, 2001). These behaviors are associated with adverse birth outcomes and with adverse long-term development of the child (Forray, 2016).

Determinants

Despite the relevance and the availability of valid instruments to assess mother-to-infant bonding, it is relatively understudied. The four reviews of determinants and mother-to-infant bonding that have been performed thus far, of which one met the criteria of a systematic review, focused on prenatal bonding only (Cannella, 2005; Laxton-Kane and Slade, 2002; Van den Bergh and Simons, 2009; Yarcheski et al., 2009). Determinants studied in the four reviews were psychosocial (e.g. social support, relationships with others, anxiety, depression and perceived stress), demographic (e.g. age, number of children, education and ethnicity), and pregnancy-related determinants (Cannella, 2005; Laxton-Kane and Slade, 2002; Van den Bergh and Simons, 2009; Yarcheski et al., 2009). These reviews are at least nine years old. Numerous studies on mother-to-infant bonding have been published since, requiring an update of the current state of knowledge.

Several studies on possible determinants of mother-to-infant bonding have been published but their quality varies substantially. Most studies have a cross-sectional design which does not allow conclusions about the temporal order of effects. Other limitations are underpowered studies and analyses which were not adjusted for possible confounders. Studies lack mediation and moderation analyses, so they contribute little to the understanding of the mechanisms behind mother-to-infant bonding.

Further, some possible determinants have never been investigated before, despite the plausibility of their influence and their potential impact, a notable example being intrapartum synthetic oxytocin. A systematic review examined the association of intrapartum synthetic oxytocin with several child neurodevelopmental outcomes. They reported a modestly increased risk of autism spectrum disorders (Lønfeldt et al., 2019). Only one study included in this review investigated child behavioral and emotional problems as an outcome (Guastella et al., 2018). Postnatal depressive symptoms and postnatal anxiety symptoms have shown to be predictors of an increased risk of child behavioral and emotional problems and may theoretically concern mediators of the association between exposure to intrapartum synthetic oxytocin and child behavioral and emotional functioning (Goodman et al., 2011; Stein et al., 2014; Glasheen et al., 2010; van Batenburg et al., 2013). Yet, their associations with intrapartum synthetic oxytocin are less clear. Just like maternal depressive and anxious symptoms, mother-to-infant bonding could play a mediating role in an association between

intrapartum synthetic oxytocin and child behavioral and emotional problems (Mason et al., 2011; Arguz Cildir et al., 2019).

In this dissertation, we decided to use 'determinants' as a collective term for both causal and non-causal determinants. We are aware that this is a simplification of the truth. A determinant is a variable which is associated with the outcome. It is important to note that the term 'associated' describes statistically significant paths, not causal effects. The term correlates contains both concurrent and prospective correlates.

The fact that some possible determinants have not been investigated at all, and some determinants only long ago or in low-quality studies, is unfortunate as more understanding of mother-to-infant bonding, with its roots in early pregnancy, may have important implications for both child development and subsequently for maternal health care.

Child development

Children represent the future, and - according to the World Health Organization - ensuring their physical, socio-emotional and language and cognitive development ought to be a priority for all societies. Addressing early child development means creating the conditions for children – from gestation to 8 years of age – to be able to thrive in their physical, socio-emotional, and language/cognitive development (WHO, 2019). Stable, caring, good relationships with adults will promote healthy brain development of young children. Conversely, adverse early experiences greatly increase the likelihood of poor health and development across the entire life course (WHO,2019).

This dissertation included studies using child behavioral and emotional problems as an outcome measure because of their long-term consequences. Child behavioral and emotional problems influence parenting, but more importantly these early childhood problems can persist to a considerable degree into adulthood (Hofstra et al., 2000). In the long run, children with behavioral and emotional problems in their infancy are at greater risk for developing mental disorders in adulthood than children without these problems. Moreover, different types of continuities of children's psychopathology exist across the lifespan (Reef et al., 2010). They result from complex mechanisms that are not yet fully understood although their understanding potentially has important societal impact. Nevertheless, this long-term prognosis is not part of the current dissertation.

In this dissertation, we assess the socio-emotional child development by focusing on child

behavioral and emotional problems up to the age of five (Achenbach and Rescorla, 2000). In this dissertation we distinguishe between internalizing problems and externalizing problems. Internalizing problems are defined as inner-directed and generating distress in the individual, while externalizing problems are defined as outer-directed and generating discomfort and conflict in the surrounding environment (Forns et al., 2014).

Role of maternal health care

Maternal health care providers are usually midwives or gynecologists and, depending on the location of care, general practitioners, nurses or maternity care assistants. Maternal health care aims at optimizing mental and physical health for both mother and child (WHO, 2015). In that respect the World Health Organization recommends to address the transition to motherhood in antenatal care to create the possibility to achieve a positive motherhood for all women (Tunçalp et al., 2017; WHO, 2016). It is important to monitor the transition to motherhood already during pregnancy, because this is an ongoing process. International guidelines in the field of maternal health care do not often include recommendations on addressing mother-to-infant bonding during the prenatal phase. Usually they have more focus on mother-to-infant bonding during the postnatal period. We do not know to what extent attention is paid to mother-to-infant-bonding in maternal health care.

As stated before, no recent overview of studies on determinants of mother-to-infant bonding exists and their predictive value is still unknown. So, the ability to predict mother-to-infant bonding early in pregnancy is still not fully evaluated. In daily practice midwives and other maternal health care professionals have no tool to identify women at risk of bonding problems in early pregnancy. A tool based on identified risk factors from different domains yielding an estimation of the risk of suboptimal bonding would therefore clearly meet a need.

Two reviews of prenatal interventions aimed at optimizing mother-to-infant bonding exist (de Jong-Pleij et al., 2013; Cunen et al., 2017), but both reviews have limitations. One review focused specifically on the effects of three-dimensional ultrasound examinantions and, moreover, was not systematically performed (de Jong-Pleij et al., 2013). The second review used an unclear definition of mother-to-infant bonding (Cunen et al., 2017). The majority of the included studies in both reviews did not make a comparison between the intervention and care as usual. To optimize mother-to-infant bonding during pregnancy, a systematic review of the literature addressing the effectiveness of the available prenatal interventions is needed.

Taken together, several knowledge gaps exist relevant to mother-to-infant bonding. These gaps are in the field of etiology (e.g. determinants and their role in mechanisms of mother-to-infant bonding). The current knowledge base on the links of mother-to-infant bonding to socio-emotional child development is not very strong either. The knowledge gaps are also in the field of maternal health care (e.g. possibly preventive prenatal interventions and the prediction of mother-to-infant bonding early in pregnancy). Filling these gaps is needed to be able to address and optimize mother-to-infant bonding in maternal health care, for example by implementing adequate monitoring strategies.

Overall aim and outline of this dissertation

The overall aim of this dissertation is therefore to further explore mechanisms of mother-to-infant bonding and to evaluate associations between mother-to-infant bonding and socio-emotional child development. Ultimately, the results may support maternal health care providers in addressing the transition to motherhood and mother-to-infant bonding in daily practice. The results of this dissertation can also be relevant for other health care professionals like psychologists, psychiatrists and pedagogical professionals.

Part one of this dissertation addresses some etiological aspects.

The following research questions will be addressed:

1. What are the correlates of both prenatal and postnatal mother-to-infant bonding quality in the general population?
2. Is the intrapartum use of synthetic oxytocin associated with behavioral and emotional problems of children aged up to five years? And what is the role of maternal mental health (postnatal depressive symptoms, anxiety, and mother-to-infant bonding) therein?

Chapter two describes the results of a systematic review of correlates of prenatal and postnatal mother-to-infant bonding quality. **Chapter three** presents a study on the association of intrapartum synthetic oxytocin administration with child behavioral and emotional problems up to early childhood and the role of maternal mental health (postnatal depressive symptoms, anxiety, and mother-to-infant bonding).

Part two focuses on two topics: transition to motherhood and mother-to-infant bonding.

The following research questions will be addressed in part two:

1. To what extent do Dutch midwives address the transition to motherhood during the prenatal booking visit as recommended by the Dutch guideline Prenatal midwifery care?

2. Which prenatal interventions exist to improve mother-to-infant bonding and are these effective in comparison with care as usual?
3. Can pregnant women at risk for suboptimal mother-to-infant bonding be identified by maternal health care professionals?

Chapter four describes if and how primary care midwives adhere to the guideline of the Royal Dutch Organization of Midwives (KNOV) by addressing the transition to motherhood at the first prenatal booking visit and whether there is a difference in addressing transition to motherhood between nulliparous and multiparous women. **Chapter five** reports on a systematic review of existing prenatal interventions to optimize mother-to-infant bonding and their effectiveness. **Chapter six** includes a study in which a prediction model was developed to identify women at risk of suboptimal mother-to-infant bonding.

Chapter seven contains the summary and the general discussion of this dissertation. We will first summarize our main findings, discuss our main findings, outline methodological considerations, and present the implications of our findings.

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PART I

Etiology